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ABSTRACT

This paper is a report of user studies for developing learning strategy tool software for children. The prototype software demonstrated is designed for children with learning and behavioral disabilities. The tools consist of easy-to-use templates for creating organizational, memory, and learning approach guides for use in classrooms and at home. User studies that were conducted with software prototypes included two rounds of expert review, usability testing in a lab setting with teachers and parents, a focus group with parents and educators, and "think aloud" observations of children using a sample of the tools. Results were used in improving the software, preparing the teacher orientation module, and designing online supports for users. The most useful dimensions of evaluation were found to be direct observation of children using the software and messages contributed by a high school student with learning disabilities to the Online Focus Group. (Contains 19 references and 3 figures.) (Author)

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User Studies: Developing Learning Strategy Tool Software for Children

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Abstract: This paper is a report of user studies for developing learning strategy tool software for children. The prototype software demonstrated is designed for children with learning and behavioral disabilities. The tools consist of easy-to-use templates for creating organizational, memory, and learning approach guides for use in classrooms and at home. User studies that were conducted with software prototypes included two rounds of expert review, usability testing in a lab setting with teachers and parents, a focus group with parents and educators, and "think-aloud" observations of children using a sample of the tools. Results were used in improving the software, preparing the teacher orientation module, and designing online supports for users. The most useful dimensions of evaluation were found to be direct observation of children using the software and messages contributed by a high school student with learning disabilities to the Online Focus Group.

Service to children with behavioral and learning disorders is a high priority in the U.S. (Elam, Rose, & Gallup, 1998; Kay, 1999). Currently, federal mandates require that such children be served in the "least restrictive environment" by providing appropriate supports and effective strategies to ensure success (IDEA97). Common problems faced by these students in regular classrooms are difficulties maintaining attention, organizing work, managing time and materials, and responding with accuracy (Lewis & Doorlag, 1999). With these deficiencies students are at-risk for increased behavioral problems, failure, and ultimately, removal from these classrooms. Research shows, however, that strategy instruction in these skills can help students become successful learners and managers of their own behavior (Swanson & Hoskyn, 1998).

Electronic Performance Support for Children with Learning and Behavior Problems

Computer-based training and support mechanisms are an innovative approach for helping children gain control over personal behaviors. While electronic performance support systems have been used in education and industry to support adults in learning new skills "at the right place, right time, right form" (Laffey, 1995), work is scant in applying these principles to the development of software tools for children. If the goal of EPSS software is appropriate for adults—to provide whatever is necessary to ensure performance and learning at the moment of need in a seamless activity—then it offers the same potential for helping children improve performance in their learning environments. If effective, EPSS support tools for children improve their

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independent functioning, reduce teacher time re-focusing their mistakes and energies, and offer lifelong skills for success.

This paper reports the design process followed by the developers in creating a new set of EPSS tools to help young children learn and use these school survival strategies. These unique materials include four components: (1) strategy software tools for children, (2) an information resource database for teachers, (3) a web-based orientation module for teachers, and (4) online resources and discussion lists to support teachers and parents (refer to conceptual framework in Figure 1) (Fitzgerald & Koury, 2001-2002). During the development period, a variety of user studies were conducted with children, parents and educators to ensure that the materials represent best practices in the field. This paper summarizes the user studies and initial findings and highlights important issues in software design for children.

Related Work: Previous Applications with EPSS Tools with Children

Computer-based training and support mechanisms are an innovative approach for helping children gain control over personal behaviors. Although there are limited data on the use of computer-based instruction to support behavior change in children to date, research results are promising. Fitzgerald and Werner (1996) reported success with a computerized verbal mediation essay as a cognitive retraining procedure to assist a student with significant behavioral disorders in changing his behavior; the computerized essay provided consistent practice and focused the child's attention and thoughts on behavioral choices and consequences. In another case study, the same researchers reported a procedure in which software templates were developed for a student to create self-monitoring materials.

Following these early studies, the developers created a series of EPSS tools for children that supported children in using self-management skills in classrooms (Fitzgerald & Semrau, 1998-2000). The children's software programs, *First Step KidTools* for ages 7-10, and *Second Step KidTools* for ages 11-14, provide a series of progressively complex templates to be used as tools. In using the tools, children identify behaviors for self-improvement, identify specific self-control strategies they want to use, prepare self-talk statements to guide their use of the strategies, and create/print-out materials to support their plans. Both software programs consist of tool templates that are kid-friendly with colorful graphics, text-with-audio directions, multiple examples, simple formats, and automatic record-keeping capabilities. To use the tools, the child simply clicks on "hot words" on the template form to enter personalized content and then print out the completed form for use in the classroom or home.

Qualitative methodologies were used to gather multiple data on the usefulness of the approach and important design features in the software. Several important design decisions were made based on these studies that have been applied to the production of the new strategy software: (1) include the option of spoken text for poor readers; (2) use children as on-screen guides through the tools; (3) use children's voices for narration; (4) provide access to help screens that can be accessed while using the tools; (5) provide multiple options to re-start or make changes; and (6) put the child in charge of creating his/her tools using natural language. Pilot testing with *KidTools* in two states demonstrated that children were able to independently use the tools and were motivated by the computerized tool format. Teachers reported improved motivation and self-control in classrooms. The findings from *KidTools* are extended to the production of *KidSkills* with its new focus on learning strategies. The previous work ensures appropriate literacy and ease-of-navigation features are included in the *KidSkills* design (Fitzgerald, Watson, Lynch & Semrau, 1999).

Conceptual Framework for the Design of *KidSkills*

Recognizing the importance of ecological variables surrounding an innovation systems (Peled, Peled, & Alexander, 1994), multiple products are being developed in a systems approach. The primary components of this framework are illustrated in Figure 1: development of the EPSS software, development of a resource information database for educators and parents, development of an orientation module, and use of online focus groups and a web-based hotline to share information, provide support, and disseminate materials during implementation.

KidSkills, the children's software, offers strategies based on cognitive-behavioral approaches that help youngsters change *cognitions* (thoughts, beliefs, self-talk, cues) and *behaviors* (actions) within a problem-solving framework to gain successful outcomes. These approaches have increased in popularity during the last two decades as researchers have documented their effectiveness (Gresham, 1985) and curriculum developers have designed and disseminated teachable programs for implementation in schools (Anderson, 1981; Nichols, 1999). To date, there have been no known precursors to this work that combines electronic performance support tools along with strategy training for teaching cognitive-behavioral strategies to young children.

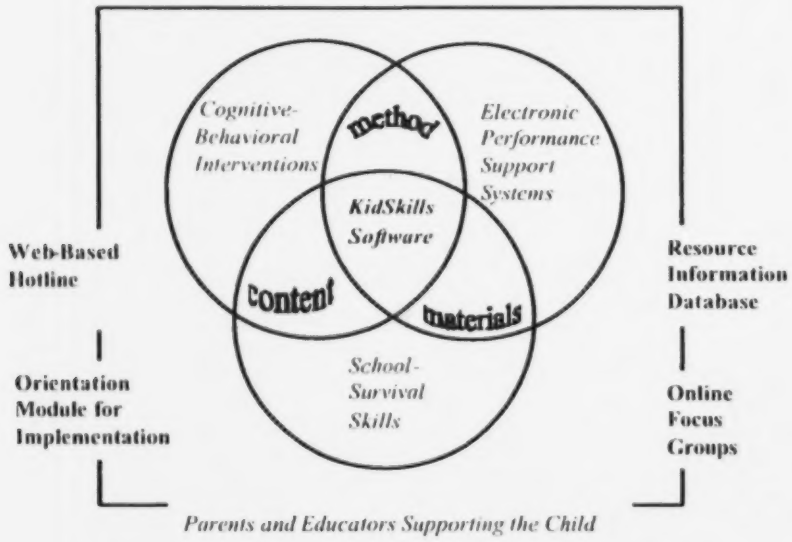

Fig. 1 Conceptual Framework for Development of *KidSkills*

The *KidSkills* Prototype

There are two levels of *KidSkills*. *First Step KidSkills* is designed for ages 7-10 and *Second Step KidSkills* for ages 11-14. There are 18 tools in *First Step KidSkills* organized in the categories of: Getting Organized, Learning New Stuff, Doing Homework, and Doing Projects. There are 30 tools in *Second Step KidSkills* organized in the categories of: Getting Organized, Learning New Stuff, Organizing Information, Preparing for Tests, Doing Homework, and Doing Projects. Information on these strategies is provided in a resource information database program, *Skill Resources*, to provide educators and parents resources to assist children during implementation. A teacher orientation module is currently being developed, including a PowerPoint presentation, demonstration videos, and a web-based hotline for assistance.

The software contains colorful graphics, text-with-audio directions, and simple formats. Graphic characters serve as "guides" to the different tools and provide audio directions in children's voices. The text and audio in *KidSkills* allow for children to enter text in their own words. The audio directions supplement the simplified text instructions and can be turned on or off. To use the tools, the child simply clicks on "hot words" on the template form to enter his or her content and then prints the completed form for use in the classroom or home. Children have instant access to examples with directions and flexible ways to re-start when desired. The program automatically enters the child's name, date, and establishes an audit trail for record-keeping purposes. These audit trails are instrumental in tracking the development of children's thinking and skill decisions.

Figure 2 displays the main menu screen for *Second Step KidSkills*. Children select tools from categories by clicking on the hot areas on the screen or by using the pull-down menu. Figure 3 shows an example of a completed *Second Step* tool. In this example, the KWL (Knows...Wants to know...Learned) tool provides a learning strategy to help the learner focus on important information when learning new material and integrate

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new information with his/her current information. This helps the learner re-structure knowledge. The child would enter the following information: the ***class, topic, source*** of information, what the child ***knows, wants to learn***, and ***what was learned***. The tool could be used prior to studying to guide learning, or as a follow-up to review information.

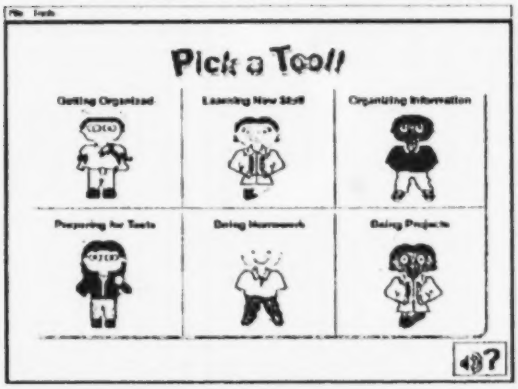

Figure 2. Main Menu from *Second Step KidSkills*

Figure 3. Sample **KWL** Tool

User Studies in the Developmental Process

The software development process is recursive, going through several phases of development→ testing→ revision based on procedures recommended by designers of children's software (Druin, 1999) and evaluators of interactive learning systems (Reeves & Hedberg, 2002). The first step of formative evaluation, design testing, includes three processes: 1) review of content and interface design by experts in learning strategies and children's software design, 2) observations of adults working with the prototypes, and 3) focus group meetings with parents and educators to discuss the tools and consumer training needs. The second step of formative evaluation, usability testing, includes three processes: 4) observations of children using a sample of the tools while collecting "think-aloud" transcripts, 5) examination of tool artifacts, and 6) expert reviews of the completed software. These six developmental steps lead to a full beta testing of the software, training, and support modules.

Expert Review of Paper Prototypes

Paper copies of all the tools were reviewed by eight content experts, including teachers, administrators, university personnel and a parent of a learning disabled child. Each reviewer used a structured questionnaire to provide feedback on screen design, content of the tools, terminology for children, and other literacy features. Some of the reviewers had prior experience using the *KidTools* program and were able to give suggestions for operability. Based on these reviews, some of structural elements and terminology of the tools were changed to make them more understandable by children with learning disabilities; some tools were re-conceptualized; color coding was added to guide entries; and two new tools were created.

Design Testing in a Lab Setting

An open lab time was scheduled at a statewide special education conference for educatora and parents to "play" with the *KidSkills* prototype. During this time, two graduate research assistants staffed the lab and observed 46 adults using the software, watching for difficulties or unusual routines. Field notes were made to record comments of participants, and feedback forms were collected. Overall ratings were 8 to 9 on a 9-point Likert scale (9 being the highest). Positive comments were that the program would be fun and easy to use, the strategies would be useful for students with learning disabilities, the audio directions were helpful, and they appreciated the interactivity and multisensory approaches. Some potential problems identified were difficulty in using pull-down menus for children, desire for more graphics and larger hot spots, use of tab key to save text

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entries, desire for spell checker and thesaurus, and navigation back and forth between screens. Problems that were identified for implementation included teacher training, scheduling use within the school day, access to computers at home and school, and need for quick instructional resource.

Online Focus Group with Consumer Group Members

An online focus group was held with members of the target consumer groups, including one parent, three classroom teachers, three teacher-trainers, and a high school student with learning disabilities. Project staff also participated in the discussions. Four open-ended questions were used to engage participants: (1) acceptance and use of the software, (2) potential implementation problems, (3) recommendations for training and support, and (4) other suggestions. Discussion threads emerged within these broad areas. The messages were coded for themes using the qualitative analysis program, *NVivo*. With this text analysis program, information can be linked and examined across multiple sources, leading to an integration of the results (Richards, 1999). Some of the concerns that were raised were earmarked for observation of tool usage with children, particularly use of the tab key, size of text entry fields, quality of audio narration, and navigation problems. Discussion of implementation issues were helpful in designing the orientation module and planning the web hotline.

Think-Aloud Observations of Children Using Working Prototypes

Twelve children with mild-moderate disabilities were selected to participate in usability testing. These students all had learning disabilities or behavioral disorders, grades levels 2-7, ages 8-14, and received academic programming in resource or inclusive classrooms. The selected children used the software in a one-on-one setting with project staff. After an initial training period with one of software tools, children were asked to "think aloud" as they worked with the software to produce materials using three different tools (Smith & Wedman, 1988; Someren, Barnard, & Jacobijin, 1994). An observer audiotaped the sessions and made field notes in order to record the children's reactions to the interface and the overall operability of the software using observation and interview guidelines. These results were analyzed using *NVivo*.

Examination of Artifacts Created by Children Using Working Prototypes

The artifacts produced by the children were examined to answer any questions raised during earlier stages of review or suggestions made about the tools during the Online Focus Group. The software contains a complete audit trail that records out to files all tool choices and entries made during usage.

Expert Reviews of Completed Software

The completed software tool programs will be sent to a panel of experts in July, 2002. The reviewers will have background in special education (cognitive-behavioral interventions and learning strategies) and two of the reviewers will have expertise in human-interface design of software (EPSS architecture and design for children). A systematic interface design will be conducted using an assessment guidelines based on procedures for user interface studies (Schneiderman, 1998). The guidelines include overall reactions, screens, sound, graphics, content, terminology, and operability. Reviewers will submit a written report with recommendations.

Putting the Pieces Together

Although each formative evaluation procedure yielded valuable information and useful suggestions, we found summation and integration of the information to be most critical. As discussed by Maslowski & Visschler, all the possible dimensions of formative and summative evaluation are rarely conducted due to financial and time constraints (1999). Their suggestion is to evaluate the dimensions where designers face questions for the greatest benefit. It is easy to respond to each procedure with revisions and further testing, as recommended in the recursive testing process, yet this approach can lead one down false paths based on partial, rather than complete, findings. For example, adults viewed the tools and raised concerns about navigation and the use of the tab key, yet observers of children found that with very little guidance, children quickly learned to navigate and enter information into tools. Adults questioned the clarity of the children's voices for narration, yet observers reported that children found the voices appealing. Adults who tested the software found it easy to use, yet our high school student strongly recommended a hotline for teachers to answer computer-use questions.

It was clear that conflicting feedback was provided by different "voices" of expertise. The most useful dimensions to us were the direct observations of children using the tools and the messages to the Online Focus Group provided by our high school student with learning disabilities. He grasped how the tools could be used in classroom settings and the abilities and limitations of teachers in supporting roles. Above all, we learned to integrate the voices of children during the design process (Druin, 1999).

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